DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH AND FIRE OFFICES' COMMITTEE
JOINT FIRE RESEARCH ORGANIZATION

THE FIRE HAZARD OF A ~~1.5 KW~~ ELECTRIC NIGHT STORAGE HEATER

by

J. H. McGuire and Margaret Law

Summary

The fire risk due to placing fibre insulation board in contact with the front surface of a night storage heater has been investigated. It is concluded that convective cooling of the heater surface must not be restricted and the use of a guard is recommended.

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Introduction

The Joint Fire Research Organization has received reports of a number of fires attributed to the ignition of materials that were close to night storage heaters. All were discovered in the early morning and resulted in severe damage. Although the causes of most of these fires were described as unknown the possibility of their being due to the use of the heaters stimulated an investigation into the possible fire hazard. The opportunity was therefore taken of visiting the scene of one such fire, which occurred in a furniture shop, and of obtaining a substantially undamaged heater with which the following tests were carried out.

Test 1

A piece of $\frac{1}{2}$ inch fibre insulation board 21 in. x 26 in. was fixed so as to cover the front face of the heater. A 26 S.W.G. chromel-alumel thermocouple, connected to a recorder, was placed between the heater and the fibre-board at the centre of the panel.

Eight hours after switching on the supply mains (200 volts 50c/s AC) smoke was emitted from the fibre board and after 11 hours 35 minutes an area of the exposed face of the fibreboard, about 2/3 of the way up was discoloured. After 11 hours 40 minutes the fibreboard was charred through and ignited. Flame spread rapidly and the test was terminated. A temperature record of the test is given in Figure 1.

Test 2

After the heater had been switched on for a long period (in excess of 2 days) various pieces of $\frac{1}{2}$ in. fibreboard were successively fixed to the centre of the front panel, leaving a sufficient time interval between each experiment to allow the heater to regain equilibrium conditions. The equilibrium temperature rise at the centre of the front panel was 110°C . The results of the experiments are given in Table 1.

Table 1

Size of Fibreboard	Result
3 in. x 3 in.	After 3 days the colour of the inner face of the fibreboard had turned to a light brown.
6 in. x 6 in.	After $28\frac{1}{2}$ hours the centre of the inner face of the fibreboard had turned brown. The equilibrium temperature rise at this point, attained after 1 hour, was 200°C.

Table 1 (cont'd)

Size of Fibreboard	Result
9 in. x 9 in.	After 22½ hours the inner face of the fibreboard was dark brown, and was charred and cracked. The equilibrium temperature rise, attained after 1 hour, was 260°C.
12 in. x 12 in.	After 50 minutes the outer face of the fibreboard was discolouring. After 56 minutes it was glowing and after 63 minutes the fibreboard was charred through.
21 in. x 26 in.	After 15 minutes smoke was emitted and the fibreboard caught fire after 44 minutes.

Test 3

The front panel of the heater was again insulated by ½ in. fibre insulation board and the heater was switched on for 9 hours per day for 3 days. The temperature rise at the centre of the front panel was the same on the second and third days and reached a maximum value of 260°C, smoke being evolved and the fibreboard becoming severely blackened. The temperature record of this test is given in Figure 2.

Conclusions

If a sheet of ½ in. thick fibre insulation board covers the whole of the front face of the heater, the temperature rise of the fibreboard can be expected to exceed 150°C within 6 hours of switching on. Within 12 hours the fibreboard will most probably ignite.

If the area of the heater covered by fibreboard is less than 3 in. square, then no hazard exists.

Since the power input to the heater is independent of the temperature the separation of the heater from combustible material by any insulating medium would be ineffective in reducing the fire hazard. The only solution would seem to be that of separating combustible materials while allowing free convection from the heater and it is suggested that the heater should be surrounded by a rigid guard with a mesh not exceeding 3 in. x 3 in.

A minimum separation of 1½ in. between the guard and all faces of the heater should be suitable.

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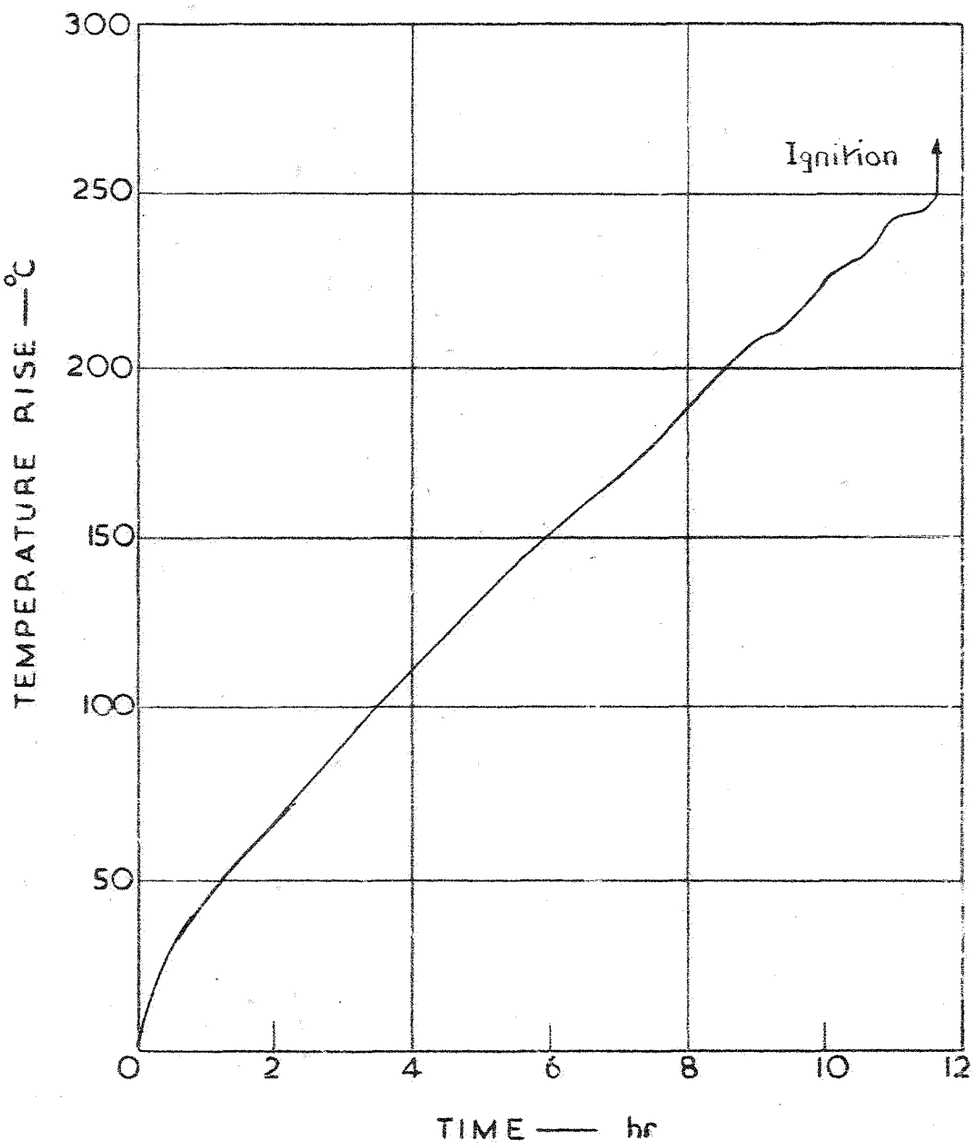

FIG. 1. TEMPERATURE RISE AT CENTRE OF FRONT PANEL WHEN COVERED WITH FIBREBOARD

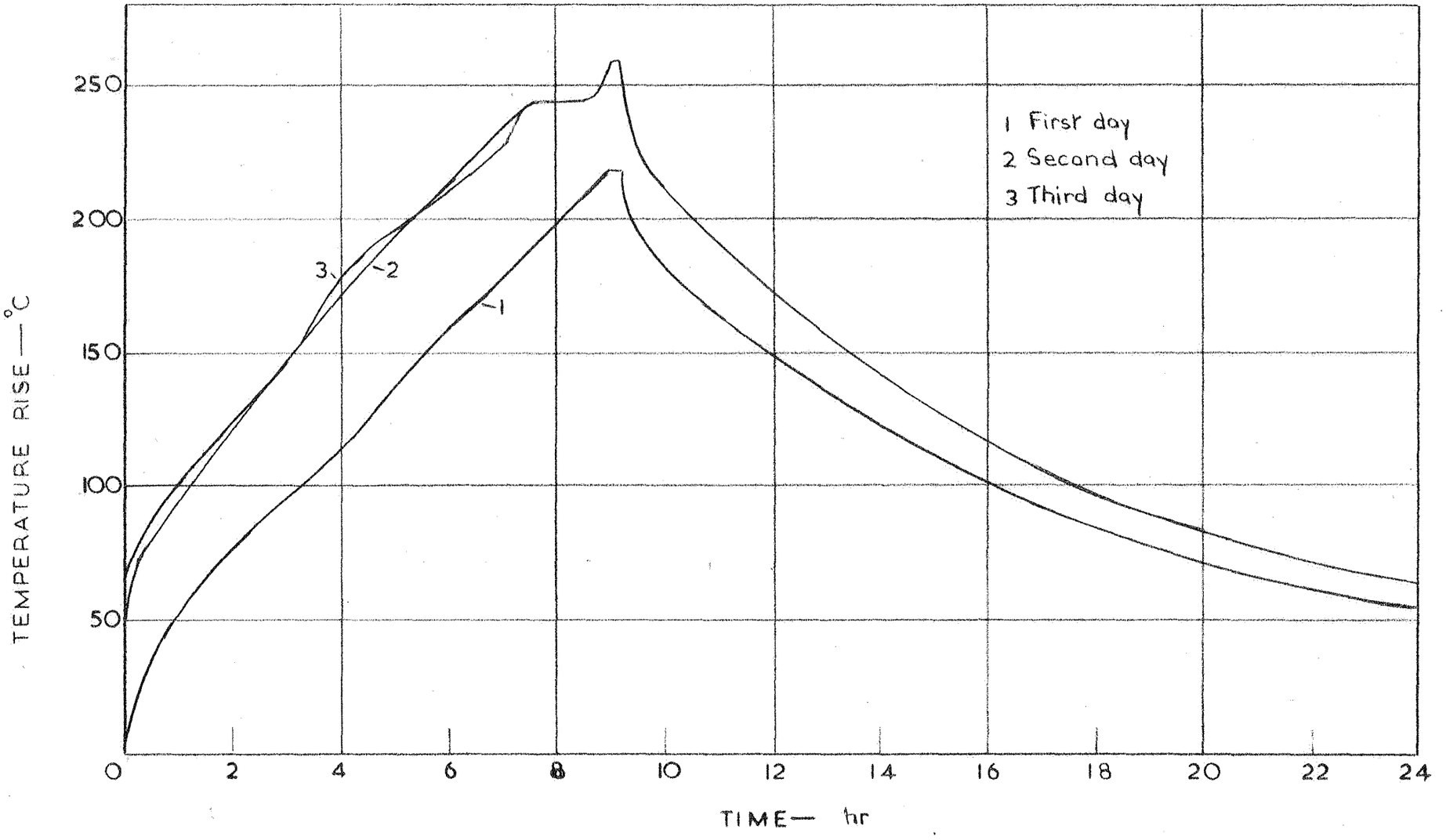

FIG.2. TEMPERATURE RISE AT CENTRE OF FRONT PANEL WHEN COVERED WITH FIBREBOARD AND HEATED FOR 9 HOURS PER DAY


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